0008-FA-US

Respectfully Submitted,

25 September 2006

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I, Wayne E. Nacker, Wayne E Nacker, reg. No. 29,571, certify that this paper was sent to the USPTO by fax: 571-273-8300 on 25 September 2006.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Hunt et al.)	Art Unit: 1762
Serial No. 09/748,714 conf. No. 4539)	Examiner: Timothy Howard Meeks
Filed: 21 December 2000)	
For: CHEMICAL VAPOR DEPOSITION METHODS FOR MAKING POWDERS AND COATINGS, AND COATINGS MADE USING THESE METHODS)	

RESPONSE TO OFFICE ACTION OF 19 SEPTEMBER 2005 (accompanying petition to revive)

Assistant Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is in response to the Office Action dated 19 September 2005.

An Amended set of claims is attached hereto as Appendix A. Each of the independent claims has been amended to recite that the precursor material and/or gases admixed with the precursor materials undergo combustion to produce combustion products that form material on a surface. Furthermore, each independent claim is amended to clarify that the combustion products initially travel along a first path and are redirected to travel along a second path at an angle relative to the first path. Accordingly, none of the independent claims are anticipated by McKee or Affinito or obvious from McKee, Affinito or Schutze in view of McKee.

Combustion Chemical Vapor Deposition (CCVD) as described in U.S. Patent No. 5,652,021 is an efficient way to deposit materials on substrates. CCVD may be carried out in open atmosphere. Generally in CCVD processes, a flame produced by oxidizing precursors and/or carrier gases is directed at a substrate surface, whereby combustion products deposit as material on the substrate surface.

While it is generally the case that the CCVD flame be directed at the substrate surface so that the combustion products follow a direct path to the surface, the present invention addresses, for example, the problem with coating heat-sensitive surfaces with flame-produced combustion products. Herein, the combustion products initially follow a first path, but are redirected along a path at an angle to the first path to the substrate surface. This allows the combustion products to reach the substrate surface at a lower temperature and form the material on the surface without excess heat damaging the substrate.

Neither McKee nor Affinito employ combustion to produce a product. McKee uses a plasma to etch or deposit on a wafer. Affinito uses plasma and heat to evaporate liquid from a monomer and cure the monomer into a polymer. Accordingly, neither of these references discuss the problem of depositing combustion products on heat-sensitive materials, and neither of these references provide methods or apparatus that would address this problem.

McKee does not direct the plasma (74) from a first path to a redirected path at an angle relative to the first path. Rather McKee uses gases, e.g., (72) and (78) to produce (perhaps by turbulence) a more even distribution of the plasma on the substrate surface. However, the linear path of plasma (74) remains the same—directly at the substrate. Accordingly, none of the currently presented independent claims, each of which involves combustion and redirection of combustion products, is anticipated by or obvious in view of McKee.

The apparatus of Affinito is simply not practical for depositing materials by CCVD. In the apparatus illustrated and described in Affinito, too much of the combustion product would deposit internally within the apparatus, either because of the restricted orifice (128) (which eventually defines the path to the substrate in the Fig. 2 and 3 embodiments) or the series of baffles in the Fig. 2 embodiment. Auxiliary gas may be introduced through (130), but this is upstream from opening (128) and, while the auxiliary gas may provide for better mixing, it ultimately does not change the flow path that is defined from the opening (128) to the substrate surface (102). While in the instant invention redirect gases address the problem of heated combustion products harming heat-sensitive substrates, the baffles (126) in Affinito must be heated (see top of Col. 6) to prevent cryocondensation. This is counter to the purpose of redirection of the present invention where it is desired that the combustion products cool before reaching the substrate surface. Accordingly, the independent claims currently presented are neither anticipated by nor obvious from Affinito.

Regarding the obviousness rejection in paragraph 11 of the Examiner's action, Schutze in view of McKee, the Examiner concedes that there is no redirection of combustion products in Schutze. In fact, it appears that the deposition medium in Schutze is plasma, not flame. As discussed above, there is no redirection from a first path to a second path at an angle relative to the first path in McKee. Accordingly, the invention cannot be found in this combination of references.

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All of the claims currently presented are believed to be in condition for allowance. Favorable action is courteously requested.

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Appendix A

1. (Currently amended) A method of forming a material, said method comprising:

(a) providing at least one energy source;

(b) feeding a precursor material along a first path into a localized environment of the at least one energy source~~, to allow the at least one energy source to activate the precursor material within gasses and~~ under conditions that said energy source causes combustion of at least one component of said precursor material to produce combustion products that continue along said first path, ~~to direct the precursor material and the gasses along a first path~~; and

(c) providing at least one ~~additional~~ redirecting gas flow source and applying the at least one ~~additional~~ redirecting gas flow to the first path combustion products ~~gasses,~~ to thereby redirect the ~~gasses~~ combustion products from the first path to a redirected path at an angle relative to said first path, to thereby cause the ~~gasses~~ combustion products to contact a surface and form at least part of the material.

2. (Currently amended) The method of claim 1, wherein causing the ~~gasses~~ combustion products to contact a surface includes contacting a substrate to form a coating of the material thereon.

3. (Original) The method of claim 2, wherein the coating is formed less than 5 microns in thickness.

4. (Original) The method of claim 2, wherein the coating is formed less than 0.5 microns in thickness.

5. (Cancelled).

6. (Currently amended) A method of forming a material, said method comprising:

(a) providing at least one energy source;

(b) providing a liquid precursor material;

(c) feeding a liquid precursor material into a localized environment of the at least one energy source under conditions that said energy source causes combustion of at least one component of said precursor material to produce combustion products ~~to allow the at least one energy source to activate the precursor material within gasses~~;

(d) directing thc ~~gasses~~ combustion products along a first path; and

(e) providing at least one source of pressure differential and applying the at least one source of pressure differential to the localized environment of the at least one energy source, such that the localized environment is selectively changed to redirect thc ~~gasses~~ combustion products from the first path to a redirected path at an angle relative to said first path, to thereby cause the ~~gasses~~ combustion products to contact a surface and form at least part of the material.

7. (Currently amended) The method of claim 6, wherein applying to the localized environment the at least one source of pressure differential includes diluting ~~the~~ combustion product gasses by at least 10%.

8. (Currently amended) The method of claim 6, wherein applying to the localized environment the at least one source of pressure differential includes diluting ~~the~~ combustion product gasses by at least 30%.

9. (Currently Amended) The method of claim 6, wherein applying to the localized environment the at least one source of pressure differential includes diluting ~~the~~ combustion product gasses by at least 60%.

10. (Currently Amended) The method of claim 6, wherein applying to the localized environment the at least onc source of pressure differential includes diluting ~~the~~ combustion product gasses by at least 100%.

11. (Currently Amended) The method of claim 6, wherein the change to the localized environment caused by providing the at least one source of pressure differential includes cooling ~~the~~ combustion product gasses by at least 10% compared to the temperature of the energy source relative to the temperature of the surface.

12. (Currently Amended) The method of claim 6, wherein the change to the localized environment caused by providing the at least one source of pressure differential includes cooling ~~the~~ combustion product gasses by at least 25% compared to the temperature of the energy source relative to the temperature of the surfacc.

13. (Currently Amended) The method of claim 6, wherein thc change to the localized environment caused by providing the at least onc source of pressure differential includes cooling ~~the~~ combustion product gasses by at least 50% compared to the temperature of the energy source relative to the temperaturc of the surface.

14. (Currently Amended) The method of claim 6, wherein the change to the localized environment caused by providing the at least one source of pressure differential includes cooling ~~the~~ combustion product gasses by at least 70% compared to the temperature of the energy source relative to the temperature of the surface.

15. (Original) The method of claim 1, wherein the localized environment is within 20cm of the energy source.

16. (Original) The method of claim 1, wherein the localized environment is within 10cm of the energy source.

17. (Original) The method of claim 1, wherein the localized environment is within 5cm of the energy source.

18. (Original) The method of claim 1, wherein the localized environment is within 2cm of the energy source.

19. (Previously Presented) The method of claim 6, wherein the localized environment comprises a pressurized environment having any pressure between 1-10,000 torr.

20. (Currently amended) A method of forming a material, said method comprising:

(a) providing at least one energy source;

(b) feeding a precursor material into a localized environment of the at least one energy source~~, to allow the at least one energy source to activate the precursor material within gasses and~~ under conditions that said energy source causes combustion of at least one component of said precursor material to produce combustion products, ~~to direct the precursor material and the gasses along a first path~~;

(c) directing the ~~gasses~~ combustion products along a first path; and

(d) providing at least one source of pressure differential and applying the at least one source of pressure differential to the localized environment of the at least one energy source, such that the localized environment is selectively changed to redirect the ~~gasses~~ combustion products from the first path to a redirected path at an angle relative to said first path, to thereby cause the gasses ~~gasses~~ combustion products to contact a surface and form at least part of the material in an atmospheric environment.

21. (Currently Amended) A method of forming a material, said method comprising:

(a) providing at least one energy source;

(b) feeding a precursor material within gasses, the gasses including liquid that is at least partially vaporized, into a localized environment of the at least one energy source, to allow the at least one energy source to ~~activate~~ cause combustion of the precursor material and/or the gasses and thereby produce combustion products;

(c) directing the ~~gasses~~ combustion products along a first path; and

(d) providing at least one source of pressure differential and applying the at least one source of pressure differential to the localized environment of the at least one energy source, such that the localized environment is selectively changed to redirect the ~~gasses~~ combustion products from the first path to a redirected path at an angle relative to said first path, to thereby cause the ~~gasses~~ combustion products to contact a surface and form at least part of the material.

22. (Currently amended) A method of forming a material, said method comprising:

(a) providing at least one combustion source;

(b) feeding a precursor material into a localized environment of the at least one combustion source, to allow the at least one combustion source to activate the precursor material within gasses and thereby produce combustion products;

(c) directing the ~~gasses~~ combustion products along a first path; and

(d) providing at least one source of pressure differential and applying the at least one source of pressure differential to the localized environment of the at least one combustion source, such that the localized environment is selectively changed to redirect the ~~gasses~~ combustion products from the first path to a redirected path at an angle relative to said first path, to thereby cause the ~~gasses~~ combustion products to contact a surface and form at least part of the material.

23. (Previously Presented) The method of claim 22 wherein providing at least one source of pressure differential comprises providing at least one source of pressurized fluid.

24. (Original) The method of claim 23 wherein the pressurized fluid is a gas.

25. (Currently Amended) The method of claim 24 wherein the pressurized gas is directed close to, but not directly at the at least one combustion source, thereby forming the pressure differential that redirects the ~~gasses~~ combustion products toward the surface.

26. (Currently Amended) The method of claim 24 wherein the pressurized gas intercepts the gas flow out of the at least one combustion source, thereby redirecting the ~~gasses~~ combustion products toward the surface.

27. (Original) The method of claim 23 wherein the pressurized fluid contains a liquid.

28. (Currently amended) The method of claim 23 wherein:

(a) the pressurized fluid comprises an additional precursor; and

(b) the combustion source causes the additional precursor to react to create additional ~~gasses~~ combustion products that form at least part of the material.

29. (Original) The method of claim 23 wherein:

(a) the pressurized fluid comprises additional material; and

(b) the additional material forms at least part of the formed material.

30. (Original) The method of claim 1 wherein the at least one energy source includes at least two energy sources.

31. (Previously Presented) The method of claim 22 wherein the at least one source of pressure differential includes at least one source of vacuum.

32. (Previously Presented) The method of claim 22 wherein the at least one source of pressure differential includes at least two sources of pressure differential.

33. (Original) The method of claim 32 wherein the at least two sources of pressure differential includes at least one source of vacuum and at least one source of pressurized fluid.

34. - 98. (Canceled).

99. (Previously Presented) The method of claim 21, wherein the localized environment comprises a pressurized environment having any pressure between 1-10,000 torr.

100. (Previously Presented) The method of claim 22, wherein the localized environment comprises a pressurized environment having any pressure between 1-10,000 torr.